Evaluation of Doppler Umbilical Flow in Pregnant Women with Insulin-Dependent Diabetes and Neonatal Outcome

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Abstract

In 57 pregnant insuline-dependent diabetic patients (class A-RF) Doppler umbilical S/D ratio was compared with neonatal outcome. The patients were divided into two groups: A with normal umbilical Doppler artery flow (S/D < 3.5) and B abnormal flow (S/D ≥ 3.5). There was no statistical difference between average Apgar score or birth weight in these two groups. Prematurity rate in group A was 26% and in group B 46%. The neonates with abnormal umbilical flow usually stayed longer at the hospital (19.8 ± 8.5 days), comparing with the other group (11.4 ± 4.9 days).

In the group A there were 4 congenital malformations, in the group B there was one congenital heart defect. In each group was one neonatal death.

Zusammenfassung

Bei 57 Schwangeren mit Insulin-abhängigem Diabetes (Gruppe A-RF) wurde der Doppler-Wert in der Nabelvene mit dem Zustand des Neugeborenen verglichen. Die Patienten wurden in zwei Gruppen geteilt: Gruppe A mit normalem Doppler-Wert (S/D < 3.5) und

Gruppe B mit anormalem Durchfluß (S/D $\geq$ 3.5). Es gab keine statistischen Unterschiede zwischen dem mittleren Apgar-Wert oder dem Geburtsgewicht zwischen diesen beiden Gruppen. Die Frühgeburtsrate betrug in Gruppe A 26% und in Gruppe B 46%. Die Neugeborenen mit anormalem Durchfluß in den Nabelgefäßen blieben gewöhnlich länger im Krankenhaus (18.8 $\pm$ 8.5 Tage) im Vergleich mit der anderen Gruppe (11.4 $\pm$ 4.9 Tage).

In der Gruppe A gab es 4 angeborene Mißbildungen, in der Gruppe B gab es einen angeborenen Herzfehler. In jeder Gruppe verstarb ein Kind in der Neugeborenenperiode.

Introduction

Doppler umbilical artery velocimetry has been proposed as a clinical tool for an antepartum fetal surveillance in pregnancies at risk for placental vascular disease[1]. Abnormal umbilical artery waveforms were associated with the development of preeclampsia and fetal growth retardation[1−3]. Pregnant women with insulin-dependent diabetes are at increased risk for these conditions, yet there is a limited information of an application of the Doppler ultrasonography to the population in Poland[4].

The purpose of this study was as follows: to determine whether blood flow, measured by umbilical artery waveforms, in pregnancy complicated by diabetes can predict somehow neonatal outcome.

Material and Methods

Fifty seven pregnant insulin-dependent diabetic women were enrolled in this investigation. The Doppler umbilical artery studies were performed during the second half of pregnancy (Toshiba 270 SA and Acuson 128 XP were used) and S/D ratio was calculated of minimum three distinct waveforms for each study during fetal apnea. According to White's classification there were patients with A to RF groups (Table 1). All patients had glucose monitoring on the day of examination and glycosylated hemoglobin measurements were done during each trimester (normal value, 5–8%). The findings of Doppler examination were not used specifically in the clinical management of the patients studied; however, there were available to physicians caring for these women. The patients with reversal diastolic flow in umbilical artery were not included into the study.

We arbitrary accepted the value of < 3.5 as maximum for "normal umbilical flow", which is in agreement with Dmoch data[4]. The patients with normal umbilical flow were labelled the group A and those with S/D ratio equal to or > 3.5 as the "abnormal umbilical flow" – group B.

Neonatal outcome was assessed by Apgar score, birth weight, prematurity rate and duration of the newborn's stay at the hospital in two groups of patients.

Student t-test or "u"-test for nonconcordant samples were used to assess statistical significance.

Results

In a group with normal umbilical flow (S/D ratio < 3.5) there were 8 patients with class A, 6 patients with class B, 10 patients with class C, 5 patients with class F/R and 4 patients with class R (Table 1). In a group with abnormal umbilical flow (S/D ratio > 3.5) there were 2 patients with class A, 5 patients with type B, 11 patients with type C, 3 patients with type F/R and 3 patients with type R diabetes.

Table 1. The class of diabetes in two evaluated groups of pregnant women with insuline-dependent diabetes, according to White's classification.

Type of diabetes	S/D < 3.5	> 3.5
A	8	2
B	6	5
C	10	11
F/R	5	3
R	4	3
Total 57 =	33	+ 24

The average Apgar score in the group of patients with normal umbilical flow (A) was 7.1 ± 2.6 and in group with abnormal flow (B), was 7.8 ± 1.1 and there was no statistic difference (Table 2).

Table 2. The clinical data of neonatal outcome in two evaluated groups of patients with diabetes, with normal and abnormal umbilical flow.

	S/D < 3.5	S/D > 3.5	stat. diff.
Average Apgar score	7.1 ± 2.6	7.8 ± 1.1	NS
Average birth weight	3517 ± 475	3111 ± 1090	NS
Prematurity	26.2%	46.6%	S
Days at the hospital	11.4 ± 4.9	19.8 ± 8.5	S
Congenital malformations	4/33 = 12%	1/24 = 4%	NS
Neonatal death	1	1	NS

Average birthweight in group A was 3517 ± 475 g and in group B 3111 ± 1090 g, but the difference was not significant. Prematurity rate in group A was 26% and in group B 46%. The neonates with abnormal umbilical flow usually stayed longer at the hospital (19.8 ± 8.5 days), comparing with the other group (11.4 ± 4.9 days).

In the group A there were 4 congenital malformations: duodenal atresia, hydrocephalus, hydrocephalus with severe myelomeningocoele (death after birth) and one heart malformation (atrial septal defect). In the group B there was one

congenital heart defect (coarctation of the aorta). In the group A there was one neonatal death due to hydrocephalus associated with severe myelomeningocoele and in the group B also one death due to disseminated intravascular coagulation.

Discussion

Recently, there has been increasing application of Doppler velocimetry to study the umbilical artery in complicated pregnancies. Umbilical artery waveforms can be obtained easily. The calculation of S/D ratio is believed to reflect placental vascular resistance[5]. In contrast, elevated umbilical artery S/D ratios have been associated with IUGR, fetal death, preeclampsia and chronic hypertensive disease[6].

Until recently, the evaluation of clinical assessment of S/D ratio in insuline dependent pregnancies were published on the basis of relatively small samples, for example: seven in series of Trudinger[3], 35 in series of Landon[7], 16 in series of Ishimatsu[8] and 33 in series of Bracero[9]. Even lower number of cases with abnormal umbilical artery flow were reported. It is believed that abnormal umbilical artery flow may suggest either chronic hypertension or diabetic nephropathy, or vasculopathy and preeclampsia[10]. While this remains in agreement with our clinical observations, our data indicate additionally that an elevated S/D ratio may indicate worse neonatal outcome, which means prematurity and longer hospitalization of newborns. It is noteworthy, however, that fetuses with congenital malformations of diabetic females, may also have normal umbilical waveforms. So despite the controlled glycemic status during the pregnancy, S/D ratio may be an additional important index about fetus well being and neonatal outcome.

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